

AMENDMENTS TO THE CLAIMS

1. (Original) A filtering apparatus calculating a median of N pixel values arranged in a two-dimensional area of $K \times K$ (K is an odd number not smaller than 3) of a digitized image, comprising:

receiving means for receiving said N pixel values;

removing means for removing, from said received N pixel values, first to $((N-1)/2)$ th pixel values as sorted in accordance with a prescribed order; and

sorting means for outputting, among $(N-(N-1)/2)$ pixel values remaining after removal of the pixel values by said removing means, first pixel value as sorted in accordance with said prescribed order as said median.

2. (Original) The filtering apparatus according to claim 1, wherein said prescribed order is either ascending order or descending order.

3. (Previously presented) The filtering apparatus according to claim 1, wherein said receiving means includes

dividing means for dividing said received N pixel values into K groups each consisting of K pixel values, and

group sorting means, for each of said K groups obtained by the division by said dividing means, for receiving and sorting the pixel values of the group in accordance with said prescribed order and outputting to said removing means, said removing means including a plurality of cascade-connected pixel removing units for removing $(N-1)/2$ pixel values from said N pixel values;

each of said pixel removing units includes

a determining unit determining, among first pixel values in accordance with said prescribed order of respective ones of said K groups applied, at least one first and following pixel values in accordance with the prescribed order, and

a shift storing unit receiving, temporarily storing and outputting said pixel values of said K groups; and

said shift storing unit removes, in said group including said pixel value determined by said determining unit, said determined pixel value from said pixel values of the stored group, and shifts order of the second and the following pixel values remaining after the removal in accordance with said prescribed order before outputting.

4. (Original) A filtering apparatus calculating a median of N pixel values arranged in a two-dimensional area of $K \times K$ (K is an odd number not smaller than 3) of a digitized image, comprising:

receiving means for receiving said N pixel values;

removing means for removing, from said received N pixel values, $((N-1)/2+2)$ to N th pixel values as sorted in accordance with a prescribed order; and

sorting means for outputting, among $(N-(N-1)/2)$ pixel values remaining after removal of the pixel values by said removing means, $(N-(N-1)/2)$ th pixel value as sorted in accordance with said prescribed order as said median.

5. (Original) The filtering apparatus according to claim 4, wherein said prescribed order is either ascending order or descending order.

6. (Previously presented) The filtering apparatus according to claim 4, wherein said receiving means includes

dividing means for dividing said received N pixel values into K groups each consisting of K pixel values, and

group sorting means, for each of said K groups obtained by the division by said dividing means, for receiving and sorting the pixel values of the group in accordance with said prescribed order and outputting to said removing means; said removing means including a plurality of cascade-connected pixel removing units for removing $(N-1)/2$ pixel values from said N pixel values;

each of said pixel removing units includes

a determining unit determining, among first pixel values in accordance with said prescribed order of respective ones of said K groups applied, at least one first and following pixel values in accordance with the prescribed order, and

a shift storing unit receiving, temporarily storing and outputting said pixel values of said K groups; and

said shift storing unit removes, in said group including said pixel value determined by said determining unit, said determined pixel value from said pixel values of the stored group, and shifts order of the second and the following pixel values remaining after the removal in accordance with said prescribed order before outputting.

7. (Previously presented) A filtering apparatus calculating, where a plurality of local areas including N pixel values of $K \times K$ (K is an odd number not smaller than 3) being arranged overlapped with each other in a prescribed area of a digitized image, a median of N pixel values of each of the local areas, said apparatus comprising:

receiving means for receiving pixel values of said prescribed area and for outputting, for each of said plurality of local areas, N pixel values included in the local area; and

median extracting means corresponding to each of said plurality of local areas;

wherein said median extracting means includes

removing means, receiving from said receiving means N pixel values included in corresponding said local area, for removing, from the input pixel values, first to $((N-1)/2)$ th pixel values as sorted in accordance with a prescribed order, and

sorting means for outputting, among $(N-(N-1)/2)$ pixel values remaining after removal of the pixel values by said removing means, first pixel value as sorted in accordance with said prescribed order, as said median.

8. (Original) The filtering apparatus according to claim 7, wherein said prescribed order is either ascending order or descending order.

9. (Previously presented) The filtering apparatus according to claim 7, wherein said receiving means includes

dividing means for dividing said received pixel values of said local areas into a plurality of groups each consisting of K pixel values, and

group sorting means, for each of said plurality of groups obtained by the division by said dividing means, for receiving and sorting the pixel values of the group in accordance with said prescribed order and outputting to said removing means corresponding to said local area to which the group belongs, said removing means having a plurality of cascade-connected pixel removing units for removing $(N-1)/2$ pixel values from said N pixel values;

each of said pixel removing units includes

a determining unit determining, among first pixel values in accordance with said prescribed order of respective ones of said K groups applied, at least one first and following pixel values in accordance with said prescribed order, and

a shift storing unit receiving, temporarily storing and outputting said pixel values of said K groups; and

said shift storing unit removes, in said group including said pixel value determined by said determining unit, said determined pixel value from said pixel values of the stored group, and shifts order of the second and the following pixel values remaining after the removal in accordance with said prescribed order before outputting.

10. (Previously presented) A filtering apparatus calculating, where a plurality of local areas including N pixel values of $K \times K$ (K is an odd number not smaller than 3) is arranged overlapped with each other in a prescribed area of a digitized image, a median of N pixel values of each of the local areas, said apparatus comprising:

receiving means for receiving pixel values of said prescribed area and for outputting, for each of said plurality of local areas, N pixel values included in the local area; and

median extracting means corresponding to each of said plurality of local areas, said median extracting means including

removing means, receiving from said receiving means N pixel values included in corresponding said local area, for removing, from the received pixel values, $((N-1)/2)+2$ th to Nth pixel values as sorted in accordance with a prescribed order, and

sorting means outputting, among $(N-(N-1)/2)$ pixel values remaining after removal of the pixel values by said removing means, $(N-(N-1)/2)$ th pixel value as sorted in accordance with said prescribed order, as said median.

11. (Original) The filtering apparatus according to claim 10, wherein said prescribed order is either ascending order or descending order.

12. (Previously presented) The filtering apparatus according to claim 10, wherein
said receiving means includes
dividing means for dividing said received pixel values of said local areas into a plurality of groups each consisting of K pixel values, and
group sorting means, for each of said plurality of groups obtained by the division by said dividing means, for receiving and sorting the pixel values of the group in accordance with said prescribed order and outputting to said removing means corresponding to said local area to which the group belongs;
said removing means has a plurality of cascade-connected pixel removing units for removing $(N-1)/2$ pixel values from said N pixel values;
each of said pixel removing units includes
a determining unit determining, among first pixel values in accordance with said prescribed order of respective ones of said K groups applied, at least one first and following pixel values in accordance with said prescribed order, and
a shift storing unit receiving, temporarily storing and outputting said pixel values of said K groups; and
said shift storing unit removes, in said group including said pixel value determined by said determining unit, said determined pixel value from said pixel values of the stored group, and shifts order of the second and the following pixel values remaining after the removal in accordance with said prescribed order before outputting.

13. (Previously presented) A data driven type information processing apparatus including operating means receiving a packet having at least a destination field storing destination information, an instruction field storing instruction information and data field storing data, for executing an operation in accordance with a data flow program using the received packet, wherein

said operating means includes filtering operation means for performing an operation in accordance with a median filtering instruction instructing calculation of a median of N pixel values

arranged in a two-dimensional area of $K \times K$ (K is an odd number not smaller than 3) of a digitized image, means for other operations, and branching means for outputting, based on said instruction information of said received packet, said received packet either to said filtering operation means or said means for other operations;

said filtering operation means includes

removing means for removing, from said N pixel values in said data field of said received packet, first to $((N-1)/2)$ th pixel values as sorted in accordance with a prescribed order, and

sorting means for storing, among $(N-(N-1)/2)$ pixel values remaining after removal of the pixel values by said removing means, first pixel value as sorted in accordance with said prescribed order, as said median in said data field of said packet and outputting said packet.

14. (Original) The data driven type information processing apparatus according to claim 13, wherein

said prescribed order is either ascending order or descending order.

15. (Original) The data driven type information processing apparatus according to claim 13, further comprising:

program storing means for storing said data flow program including a plurality of pieces of said destination information and a plurality of pieces of said instruction information, receiving said packet, reading subsequent said destination information and subsequent said instruction information from said data flow program, storing the read information to said destination field and said instruction field of the received packet, respectively, and outputting the received packet;

pair data detecting means for receiving said packet output from said program storing means, storing contents necessary to execute said instruction information of said instruction field of the received packet and outputting the received packet to said operating means; and

input/output control means for receiving said packet output from said operating means, and outputting to the outside or to said program storing means.

16. (Previously presented) A data driven type information processing apparatus including operating means receiving a packet having at least a destination field storing destination information, an

instruction field storing instruction information and data field storing data, for executing an operation in accordance with a data flow program using the received packet, wherein

said operating means includes filtering operation means for performing an operation in accordance with a median filtering instruction instructing calculation of a median of N pixel values arranged in a two-dimensional area of $K \times K$ (K is an odd number not smaller than 3) of a digitized image, means for other operations, and branching means for outputting, based on said instruction information of said input packet, said received packet either to said filtering operation means or said means for other operations;

said filtering operation means includes

removing means for removing, from said N pixel values in said data field of said received packet, $((N-1)/2)+2$ to N th pixel values as sorted in accordance with a prescribed order, and

sorting means for storing, among $(N-(N-1)/2)$ pixel values remaining after removal of the pixel values by said removing means, $(N-(N-1)/2)$ th pixel value as sorted in accordance with said prescribed order, as said median in said data field of said packet and outputting said packet.

17. (Original) The data driven type information processing apparatus according to claim 16, further comprising:

program storing means for storing said data flow program including a plurality of pieces of said destination information and a plurality of pieces of said instruction information, receiving said packet, reading subsequent said destination information and subsequent said instruction information from said data flow program, storing the read information to said destination field and said instruction field of the received packet, respectively, and outputting the received packet;

pair data detecting means for receiving said packet output from said program storing means, storing contents necessary to execute said instruction information of said instruction field of the received packet and outputting the received packet to said operating means; and

input/output control means for receiving said packet output from said operating means, and outputting to the outside or to said program storing means.

18. (Previously presented) A data driven type information processing apparatus including operating means receiving as a packet having at least a destination field storing destination information,

an instruction field storing instruction information and data field storing data, for executing an operation in accordance with a data flow program using the received packet, wherein

said operating means includes filtering operation means for performing an operation in accordance with a median filtering instruction instructing, where a plurality of areas including N pixel values of $K \times K$ (K is an odd number not smaller than 3) are arranged overlapped with each other in a digitized image, calculation of a median of N pixel values of each of the areas, means for other operations, and branching means for outputting, based on said instruction information of said received packet, said received packet either to said filtering operation means or said means for other operations;

said filtering operation means includes

receiving means for inputting pixel values of said plurality of local areas of said data field of said received packet, and outputting, for each of said plurality of local areas, a packet having N pixel values included in the local area stored in the data field, and

median extracting means corresponding to each of said plurality of local areas; and

said median extracting means includes

removing means, receiving from said receiving means a packet storing N pixel values included in corresponding said area, for removing, from the input pixel values, first to $((N-1)/2)$ th pixel values as sorted in accordance with a prescribed order, and

sorting means for extracting, among $(N-(N-1)/2)$ pixel values remaining after removal of the pixel values by said removing means in the data field of said packet, first pixel value as sorted in accordance with said prescribed order, as said median, storing the median in said data field of said packet and outputting the packet.

19. (Original) The data driven type information processing apparatus according to claim 18, further comprising:

program storing means for storing said data flow program including a plurality of pieces of said destination information and a plurality of pieces of said instruction information, receiving said packet, reading subsequent said destination information and subsequent said instruction information from said data flow program, storing the read information to said destination field and said instruction field of the received packet, respectively, and outputting the received packet;

pair data detecting means for receiving said packet output from said program storing

means, storing contents necessary to execute said instruction information of said instruction field of the received packet and outputting the received packet to said operating means; and

input/output control means for receiving as an input said packet output from said operating means, and outputting to the outside or to said program storing means.

20. (Previously presented) A data driven type information processing apparatus including operating means receiving a packet having at least a destination field storing destination information, an instruction field storing instruction information and data field storing data, for executing an operation in accordance with a data flow program using the received packet, wherein

said operating means includes filtering operation means for performing an operation in accordance with a median filtering instruction instructing, where a plurality of local areas including N pixel values of $K \times K$ (K is an odd number not smaller than 3) are arranged overlapped with each other in a prescribed area of a digitized image, calculation of a median of N pixel values of each of the local areas, means for other operations, and branching means for outputting, based on said instruction information of said received packet, said received packet either to said filtering operation means or said means for other operations;

said filtering operation means includes

receiving means for inputting pixel values of said prescribed area of said data field of received said packet, and outputting, for each of said plurality of local areas, a packet having N pixel values included in the local area stored in the data field, and

median extracting means corresponding to each of said plurality of local areas; and

said median extracting means includes

removing means, receiving from said receiving means a packet storing N pixel values included in corresponding said local area, for removing, from the input pixel values, $((N-1)/2)+2$ th to Nth pixel values as sorted in accordance with a prescribed order, and

sorting means for extracting, among $(N-(N-1)/2)$ pixel values remaining after removal of the pixel values by said removing means in the data field of said packet, $(N-(N-1)/2)$ th pixel value as sorted in accordance with said prescribed order, as said median, storing the median in said data field of said packet and outputting the packet.

21. (Original) The data driven type information processing apparatus according to claim 20, wherein

said prescribed order is either ascending order or descending order.

22. (Original) The data driven type information processing apparatus according to claim 20, further comprising:

program storing means for storing said data flow program including a plurality of pieces of said destination information and a plurality of pieces of said instruction information, receiving said packet, reading subsequent said destination information and subsequent said instruction information from said data flow program, storing the read information to said destination field and said instruction field of the received packet, respectively, and outputting the received packet;

pair data detecting means for receiving said packet output from said program storing means, storing contents necessary to execute said instruction information of said instruction field of the received packet and outputting the received packet to said operating means; and

input/output control means for receiving said packet output from said operating means, and outputting to the outside or to said program storing means.

23. (Original) A filtering method for calculating a median of N pixel values arranged in a two-dimensional area of $K \times K$ (K is an odd number not smaller than 3) of a digitized image, comprising:

the receiving step of receiving said N pixel values;

the removing step of removing, from said N pixel values received in said receiving step, first to $((N-1)/2)$ th pixel values as sorted in accordance with a prescribed order; and

the sorting step of outputting, among the $(N-(N-1)/2)$ pixel values remaining after the removal of the pixel values in said removing step, first pixel value as sorted in accordance with said prescribed order as said median.

24. (Original) A filtering method for calculating a median of N pixel values arranged in a

two-dimensional area of $K \times K$ (K is an odd number not smaller than 3) of a digitized image, comprising:

- the receiving step of receiving said N pixel values;
- the removing step of removing, from said N pixel values received in said receiving step, $((N-1)/2)+2$ to N th pixel values as sorted in accordance with a prescribed order; and
- the sorting step of outputting, among the $(N-(N-1)/2)$ pixel values remaining after removal of the pixel values in said removing step, $(N-(N-1)/2)$ th pixel value as sorted in accordance with said prescribed order as said median.

25. (Currently amended) ~~An apparatus-program-product to have a computer execute a filtering method, comprising:~~

- a memory storing a set of instructions, and
- a processor executing the stored set of instructions to perform a method for ~~wherein~~
~~said filtering method is for~~ calculating a median of N pixel values arranged in a two-dimensional area of $K \times K$ (K is an odd number not smaller than 3) of a digitized image, including:

- ~~the receiving step of~~ receiving said N pixel values;
- ~~the removing step of~~ removing, from said N pixel values received in said receiving step, first to $((N-1)/2)$ th pixel values as sorted in accordance with a prescribed order; and
- ~~the sorting step of~~ outputting, among the $(N-(N-1)/2)$ pixel values remaining after removal of the pixel values in said removing step, first pixel value as sorted in accordance with said prescribed order as said median.

26. (Currently amended) ~~An apparatus-program-product to have a computer execute a filtering method, comprising:~~

- a memory storing a set of instructions; and
- a processor executing the stored set of instructions, to perform a method for ~~wherein~~
~~said filtering method is for~~ calculating a median of N pixel values arranged in a two-dimensional area of $K \times K$ (K is an odd number not smaller than 3) of a digitized image,

including:

~~the receiving step of~~ receiving said N pixel values;
~~the removing step of~~ removing, from said N pixel values received in said receiving step,
((N-1)/2)+2) to Nth pixel values as sorted in accordance with a prescribed order; and
~~the sorting step of~~ outputting, among the (N-(N-1)/2) pixel values remaining after
removal of the pixel values in said removing step, (N-(N-1)/2)th pixel value as sorted in
accordance with said prescribed order as said median.

27. (Currently amended) A ~~machine~~-computer readable recording medium recording a
program to have a computer execute a filtering method, wherein

said filtering method is for calculating a median of N pixel values arranged in a two-
dimensional area of K*K (K is an odd number not smaller than 3) of a digitized image,
including:

the receiving step of receiving said N pixel values;
the removing step of removing, from said N pixel values received in said receiving step,
first to ((N-1)/2)th pixel values as sorted in accordance with a prescribed order; and
the sorting step of outputting, among the (N-(N-1)/2) pixel values remaining after
removal of the pixel values in said removing step, first pixel value as sorted in accordance with
said prescribed order, as said median.

28. (Currently amended) A ~~machine~~-computer readable recording medium recording a
program to have a computer execute a filtering method, wherein

said filtering method is for calculating a median of N pixel values arranged in a two-
dimensional area of K*K (K is an odd number not smaller than 3) of a digitized image,
including:

the receiving step of receiving said N pixel values;
the removing step of removing, from said N pixel values received in said receiving step,
((N-1)/2)+2) to Nth pixel values as sorted in accordance with a prescribed order; and
the sorting step of outputting, among the (N-(N-1)/2) pixel values remaining after

removal of the pixel values in said removing step, $(N-(N-1)/2)$ th pixel value as sorted in accordance with said prescribed order, as said median.

29. (Previously presented) A filtering method of calculating, where a plurality of areas including N pixel values of $K*K$ (K is an odd number not smaller than 3) are arranged overlapped with each other in a digitized image, a median of N pixel values of each of the areas, comprising:

the receiving step of receiving the pixel values of said plurality of areas, and outputting, for each of said plurality of areas, N pixel values included in the area; and

the median extracting step of extracting the median corresponding to each of said plurality of areas,

wherein said median extracting step includes

the removing step of removing, from said N pixel values included in corresponding said area and received in said receiving step, first to $((N-1)/2)$ th pixel values as sorted in accordance with a prescribed order; and

the sorting step of outputting, among the $(N-(N-1)/2)$ pixel values remaining after the removal of the pixel values in said removing step, first pixel value as sorted in accordance with said prescribed order, as said median.

30. (Previously presented) A filtering method of calculating, where a plurality of local areas including N pixel values of $K*K$ (K is an odd number not smaller than 3) are arranged overlapped with each other in a prescribed area of a digitized image, a median of N pixel values of each of the local areas, comprising:

the receiving step of receiving the pixel values of said prescribed area, and outputting, for each of said plurality of local areas, N pixel values included in the local area; and

the median extracting step of extracting the median corresponding to each of said plurality of local areas,

wherein said median extracting step includes

the removing step of removing, from said N pixel values included in corresponding said local area and received in said receiving step, $((N-1)/2)+2$ th to Nth pixel values as sorted in accordance with a prescribed order; and

the sorting step of outputting, among the $(N-(N-1)/2)$ pixel values remaining after the removal of the pixel values in said removing step, $(N-(N-1)/2)$ th pixel value as sorted in accordance with said prescribed order, as said median.

31. (Currently amended) An apparatus ~~program product to have a computer execute a filtering method, comprising:~~

a memory storing a set of instructions; and

a processor, for executing the stored set of instructions, to perform a method wherein

~~said filtering method~~ is for calculating, where a plurality of areas including N pixel values of $K \times K$ (K is an odd number not smaller than 3) are arranged overlapped with each other in a digitized image, a median of N pixel values of each of the local areas, including:

~~the receiving step of~~ receiving the pixel values of said plurality of areas, and outputting, for each of said plurality of areas, N pixel values included in the area; and

~~the median extracting step of~~ extracting the median corresponding to each of said plurality of areas; wherein

said ~~median~~-extracting step includes

~~the removing step of~~ removing, from said N pixel values included in corresponding said area and received in said receiving step, first to $((N-1)/2)$ th pixel values as sorted in accordance with a prescribed order; and

~~the sorting step of~~ outputting, among the $(N-(N-1)/2)$ pixel values remaining after the removal of the pixel values in said removing step, first pixel value as sorted in accordance with said prescribed order, as said median.

32. (Currently amended) An apparatus comprising: ~~program product to have a computer execute a filtering method, wherein~~

a memory storing a set of instructions; and

a processor, executing the stored set of instructions to perform a method ~~said filtering method~~ is for calculating, where a plurality of local areas including N pixel values of $K \times K$ (K is an odd number not smaller than 3) are arranged overlapped with each other in a

prescribed area of a digitized image, a median of N pixel values of each of the local areas, including:

~~the receiving step of receiving~~ as inputs the pixel values of said prescribed area, and outputting, for each of said plurality of local areas, N pixel values included in the local area; and

~~the median extracting step of extracting~~ the median corresponding to each of said plurality of local areas; wherein

said ~~median~~-extracting step includes

~~the removing step of removing~~, from said N pixel values included in corresponding said local area and received in said receiving step, $((N-1)/2)+2$ th to Nth pixel values as sorted in accordance with a prescribed order; and

~~the sorting step of outputting~~, among the $(N-(N-1)/2)$ pixel values remaining after the removal of the pixel values in said removing step, $(N-(N-1)/2)$ th pixel value as sorted in accordance with said prescribed order, as said median.

33. (Currently amended) A ~~machine~~-computer readable recording medium recording a program to have a computer execute a filtering method, wherein

said filtering method is for calculating, where a plurality of areas including N pixel values of $K*K$ (K is an odd number not smaller than 3) are arranged overlapped with each other in a digitized image, a median of N pixel values of each of the areas, including:

the receiving step of receiving the pixel values of said plurality of areas, and outputting, for each of said plurality of areas, N pixel values included in the area; and

the median extracting step of extracting the median corresponding to each of said plurality of areas; wherein

said median extracting step includes

the removing step of removing, from said N pixel values included in corresponding said area and received in said receiving step, first to $((N-1)/2)$ th pixel values as sorted in accordance with a prescribed order; and

the sorting step of outputting, among the $(N-(N-1)/2)$ pixel values remaining after the removal of the pixel values in said removing step, first pixel value as sorted in accordance with

said prescribed order, as said median.

34. (Currently amended) A ~~maehine~~-computer readable recording medium recording a program to have a computer execute a filtering method, wherein

said filtering method is for calculating, where a plurality of local areas including N pixel values of $K \times K$ (K is an odd number not smaller than 3) are arranged overlapped with each other in a prescribed area of a digitized image, a median of N pixel values of each of the local areas, including:

the receiving step of receiving the pixel values of said prescribed area, and outputting, for each of said plurality of local areas, N pixel values included in the local area; and

the median extracting step of extracting the median corresponding to each of said plurality of local areas; wherein

said median extracting step includes

the removing step of removing, from said N pixel values included in corresponding said local area and received in said receiving step, $((N-1)/2)+2$ th to Nth pixel values as sorted in accordance with a prescribed order; and

the sorting step of outputting, among the $(N-(N-1)/2)$ pixel values remaining after the removal of the pixel values in said removing step, $(N-(N-1)/2)$ th pixel value as sorted in accordance with said prescribed order, as said median.